Lesson 14

Understanding Video Standards and Technologies

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- Video Standards
- LCD-Specific Concepts
- Connections

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Video Standards

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Video Standards

The early video standards differ in two major areas:

- The highest resolution supported
- The maximum number of colors in their palette.

Both are directly related to the amount of memory on the adapter

Display adapters through the years can be divided into four primary groups:

- Monochrome
- CGA
- EGA
- VGA

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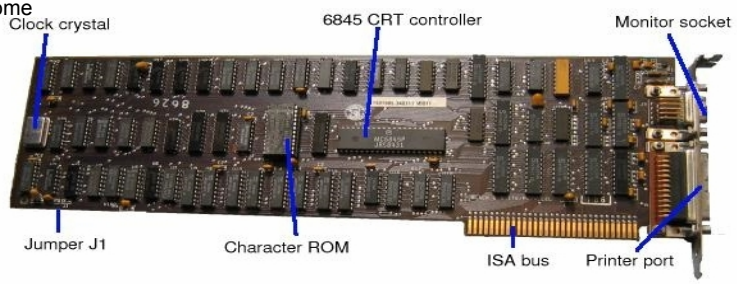
1- Monochrome Display Adapter (MDA)

- The first video technology for PCs was *monochrome (from the* Latin mono*, meaning* one*,* and chroma*, meaning* color*).*
- The card came with 4KB of video memory.
- This black-and-white video was fine for the main operating system of the day, DOS.
- The first adapter, developed by IBM, was known as the Monochrome Display Adapter (MDA).
  It could display text but not graphics and used a resolution of 720×350 pixels.
- The Hercules Graphics Card (HGC), introduced by Hercules Computer Technology, had a resolution of 720×350 and could display graphics as well as text.
  It did this by using two text mode *and a graphics mode*

•All text and graphics are displayed in that color.
The color of the monitor is determined by the color of the phosphors on the CRT screen.
•Monochrome monitors are available in three colors: if the P1 phosphor is used, the screen is green monochrome. If the P3 phosphor is used, the screen is amber monochrome. If the P4 phosphor is used, the screen is white monochrome



2- Color Graphics Adapter (CGA).

- Introduced in 1981 by IBM
- CGA video adapters were the first adapters to support color.
- The card came with 16KB of video memory.
- The CGA specification
- included 80 character by 25 line
  40 character by 25 line text in 16 colors,
- 640x200 pixel graphics in 2colors
- 320x200 pixel graphics in 4 colors.
- 160x200 pixel graphics in 16 colors

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3- Enhanced Graphics Adapter (EGA)

- Introduced by IBM in 1984
- More colors and higher resolution
- EGA supports 16 colors from a palette of 64 colors at 640 x 350 resolution.
- One new feature on the EGA adapter was the memory expansion board.
  The EGA card came standard with only 64K of memory.
  With a memory expansion card, you got an extra 64K, for a total of 128K.
  Then, with the addition of a special IBM memory module kit, you could add another 128K, for a total of 256K of graphics memory.
  One good thing, though, was that most "after market" EGA cards came equipped with the full 256K of memory.

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4- Video Graphics Array (VGA)

- It is the base standard for color PC video.
- 256KB of video memory on board
- and could display
  16 colors at 640×480, 640×350, and 320×200 pixels(256)
- 256 colors at 320×200 pixels.(18-bit palette of 262,114 colors)
- One unique feature of VGA is that it's an analog technology,

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5- Super VGA (SVGA)

- founded in 1989 by NEC Home Electronics and 8 other video display adapter manufacturers.
- support 16 colors at a resolution of 800×600(the VESA standard), but it soon expanded to support

1,024×768 pixels with 256 colors

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6- Extended Graphics Array (XGA)

- IBM introduced a new technology in 1990
- This technology was available only as a Micro Channel Architecture (MCA) expansion board and not as an ISA or EISA board.
- XGA could support 65,536 colors at 800×600 pixels OR 256 colors at 1,024×768 pixels or

More Recent Video Standards

- Any standard other than the ones already mentioned are probably extensions of SVGA or XGA.
- **UXGA** 1600X1200 pixels aspect ratio of 4:3
  U (Ultra) which is exactly quadruple the default resolution of SVGA (800x600).
- **WXGA**
  W (wider) indicates same vertical resolution but a wider horizontal resolution
- **WUXGA** 1920×1200 and a 16:10 aspect ratio
- **QXGA** 2048X1536 pixels
  Q (quadruple) *indicates that the horizontal and vertical resolutions were each doubled* XGA 1,024×768 pixels, *making* a final resolution four times (quadruple)

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aspect ratio

- refers to the number of horizontal pixels to vertical pixels in a display.
- Traditional displays used a 4:3 aspect ratio.
- Most new widescreen monitors use either a 16:10 or 16:9 aspect ratio.
- The 16:9 is the ratio typically used for HDTVs.
- Now a new breed of ultra wide monitors is coming to market. These have a near 2:1 width to high measurements.
- For example, for a display that supports 4:3 ratios, such as 1024×768, if you divide the first number by 4 and multiply the result by 3, the product is equal to the second number.
- Additionally, if you divide the first number by the second number, the result is approximately 1.3, the same as 4 ÷ 3.
- Displays with a 16:10 aspect ratio have measurements that result in a dividend of 16 ÷ 10 = 1.6

Name	Resolutions	Colors
Monochrome Display Adapter (MDA)	720×350	Mono (text only)
Hercules Graphics Card (HGC)	720×350	Mono (text and graphics)
Color Graphics Adapter (CGA)	320×200	4
	640×200	2
Enhanced Graphics Adapter (EGA)	Up to	
	640×350	16
Video Graphics Array (VGA)	640×480	16
	320×200	256
Super VGA (SVGA)	800×600	16
Extended Graphics Array (XGA)	800×600	65,536
	1024×768	256
Widescreen XGA (WXGA), 16:10	1280×800	Not specified
Super XGA (SXGA), 5:4	1280×1024	Not specified
SXGA+	1400×1050	Not specified
WSXGA+, 16:10	1680×1050	Not specified
Ultra XGA (UXGA)	1600×1200	Not specified
WUXGA, 16:10	1920×1200	Not specified
Quad XGA (QXGA)	2048×1536	Not specified
WQXGA, 16:10	2560×1600	Not specified
WQUXGA, 16:10	3840×2400	Not specified
WHUXGA, 16:10	7680×4800	Not specified

LCD-Specific Concepts

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Native resolution

- **Native resolution**
- **LCD resolutions**
- **Contrast ratio**
- **Response Rate**
- **Brightness**

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Native Resolution

- One of the peculiarities of desktop LCD displays is that they have a single fixed resolution, known as the *native resolution.*
- The display produces the sharpest picture when used at its so-called native resolution.
- The native resolution comes from the placement of the transistors in the hardware display matrix of the monitor.
- For a native resolution of 1680×1050, for example, there are 1,764,000 transistors arranged in a grid of 1680 columns and 1050 rows.
- Trying to display a resolution other than 1680×1050 Often resulting in a distortion of the image on the screen (blurred text, elliptical circles).
- Not to confuse the issue, but laptop LCDs tend not to have an apparent native resolution that they are bound to, possible because the adapter and display are factory-mated in

Here are some of the common native resolutions found in LCD monitors:

- 17-19": 1280x1024 (SXGA)
- 20"+: 1600x1200 (UXGA)
- 17" (Widescreen): 1280x800 (WXGA)
- 19" (Widescreen): 1440x900 (WXGA+)
- 22" (Widescreen): 1680x1050 (WSXGA+)
- 23.6" (Widescreen): 1920x1080 (WUXGA)
- 23" (Ultra-Widescreen): 2048x1152 (QWXGA)
- 24" (Widescreen): 1920x1200 (WUXGA)
- 30" (Widescreen): 2560x1600

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Contrast Ratio (Native static)

- Static contrast ratios is defined by the ratio of the brightest part of an LCD screen to the darkest part of an LCD screen that can be simultaneously displayed on the screen.
- A static contrast ratio is the contrast ratio at a given point in time.
- Contrast Ratio is simply the ratio between the brightest spot to the darkest spot a panel can display.
- This means on a LCD with contrast ratio of 3000:1, the whitest spot is 3000 times brighter than the darkest spot.
- Thus the contrast ratio is an indicator of the variable luminance or the brightness the LCD can produce.
- Basically a higher contrast ratio will mean that the screen will tend to have deeper blacks and brighter whites.
- Ratios for smaller LCD monitors and televisions typically start out around 500:1. Common ratios for larger units range from 20,000:1 to 100,000:1. Extreme specifications on commercial high-end televisions and monitors using LEDs as backlights have reached 1,000,000:1, as in the case of Sony's 55″ BRAVIA® XBR8.
- contrast ratios is that there is no vendor-neutral measurement.

dynamic contrast ratios

- Dynamic contrast ratios are measured by the darkest dark from one image to the brightest bright from another image being displayed at different times.
- A dynamic contrast ratio is the overall contrast ratio the television can produce over time.
- Many display manufacturers like to quote dynamic contrast ratios instead, because they are measured over time with different backlight brightness settings and produce significantly larger numbers.
- For example, a display with a 1000:1 static contrast ratio can also have an 8000:1 (or higher) dynamic contrast ratio.

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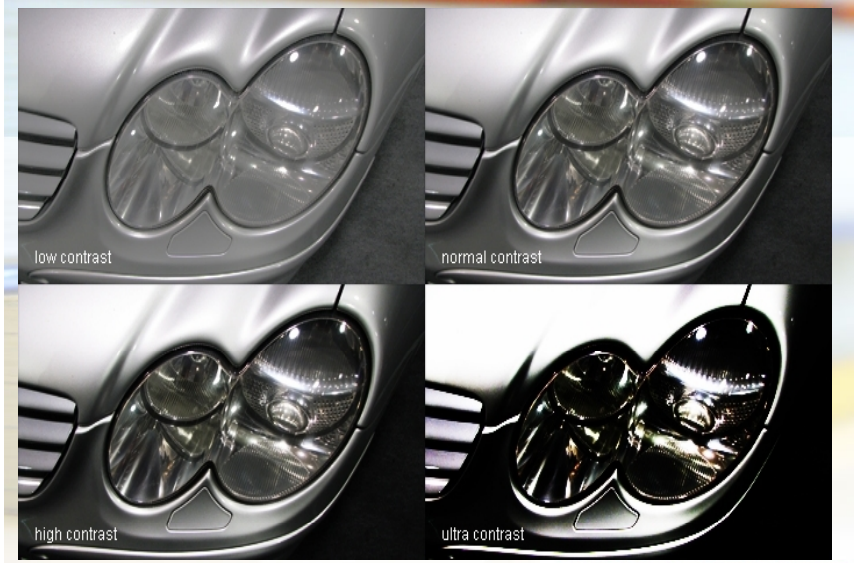

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Response Rate
Response TIME

- An LCD panel's *response rate is the amount of time it takes for all of the sub-pixels on* the panel to go from pure black to pure white and back again.
- This is roughly the same concept as the CRT refresh rate but with one important difference.
- Once the electron gun on a CRT lights a phosphor, that phosphor begins to fade until it is lit again.
- Individual LCD sub-pixels hold their intensity until the LCD circuitry changes that subpixel, making the problem of flicker nonexistent on LCDs.
- Manufacturers measure LCD response rates in milliseconds

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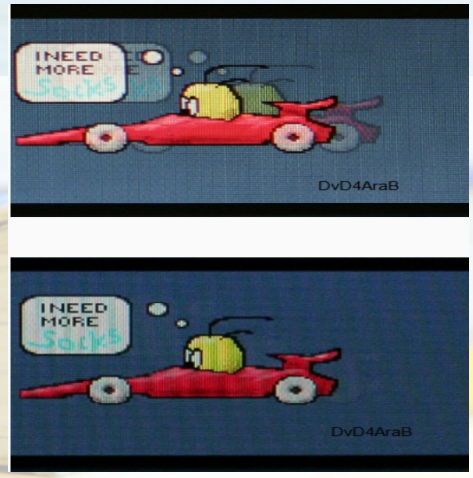

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Brightness

- The strength of an LCD monitor's backlights determines the brightness of the monitor.
- The brightness is measured in *nits.*
- *LCD panels vary from 100 nits on the low end to* over 1,000 nits or more on the high end.
- Average LCD panels are around 300 nits,which most monitor authorities consider excellent brightness.

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Connections

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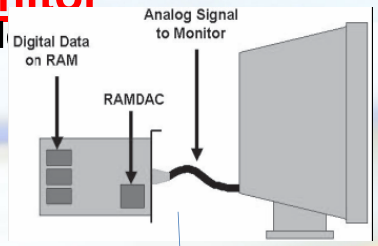
Analog output to Analog input CRT

CRT monitor

- CRT monitors use a anal signal.

A traditional CRT connection
15-pin male , three-row, DB-type connector



random access memory
digital-to-analog converter

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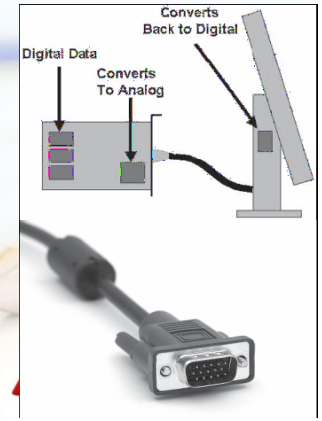
Analog output to Analog input

LCD *Analog LCD monitors.*

LCD (without DVI connection.)

- Unlike the analog CRTs, LCD monitors need a digital signal.
- However, if you want to plug your LCD monitor into a regular video card, you need circuitry on the LCD monitor to convert the signal from analog to digital
- The monitor really isn't analog; it's digital, but it takes a standard VGA input.

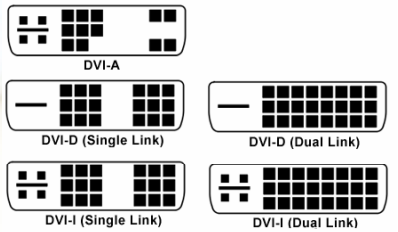


Digital LCD & Digital video cards.
DVI connection
DVI output to DVI input (Digital to Digital):

- DVI stands for (**D**)igital (**V**)ideo (**I**)nterface.
- *It use digital video interface (DVI) standard.*
- Always the best situation to have, there are no adapters to mess with and no headaches in the set up. Basically, this is a DVI connection off the video card to a DVI connection on an LCD monitor
- DVI keeps data in digital form from the computer to the r

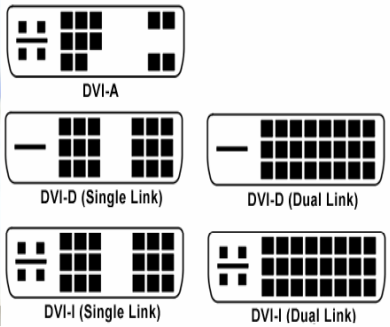
The three main categories of DVI cable connector are

1. **DVI-D** A cable and device digital-only connector
2. **DVI-A** are used to carry a DVI signal to an analog display
3. **DVI-A/D or DVII** (interchangeable) accepts either a DVI-D or DVI-A.



1-DVI-D - DVI Digital (True Digital)

- DVI-D is a direct digital connection between your video card and your monitor.
- This type of connection provides a fast transfer rate, high quality image and no quality loss due to the fact that all signals from PC's are purely digital; no digital-analog-digital conversion is needed.
- Unfortunately, due to the lack in conformity by the monitor and video card industry, this standard is not usually seen in either piece of hardware. (Of the two it's slightly more common on monitors)



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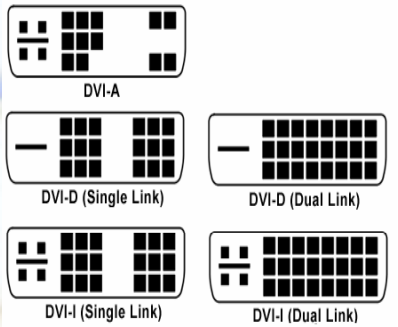
2- DVI-A - DVI Analog (High-Resolution Analog)

- This format is used to carry a DVI signal to an analog display, and we all know what that is ?CRT.
- This format is also used to carry a DVI signal to some HDTV's.
- Some image quality is lost of course due to the conversion process, but the format transmits a picture of higher quality than standard VGA formats.



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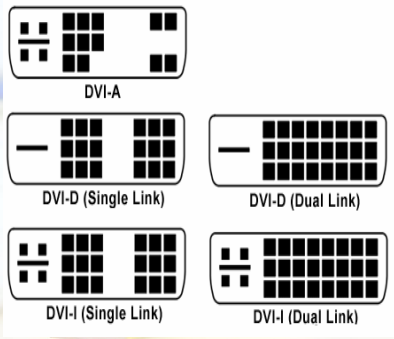
3-DVI-I - DVI Integrated (Digital and Analog in One Format)

- It supports both analog signals and digital signals in one cable.
- This means that the cable can transmit either a digital-to-digital signal or an analog-to-analog one, but it will not transmit crossovers of either one (digital-to-analog or analog-to-digital).
- It also means that if you have a DVI-I port on your video card your fine hooking up most DVI-D or DVI-A devices without needing a separate adapter.



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Note

- *None of these cables can be interchanged with other cables.*
- *A DVI-D cable cannot be placed on an analog system*
- *DVI-A cable cannot be placed on a digital system.*
- *The standards can not be mixed.*
- *A DVI-I port however can accept another DVI-I, DVI-D or DVI-A cable.*

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The DVI-D and DVI-I connectors come in two varieties:

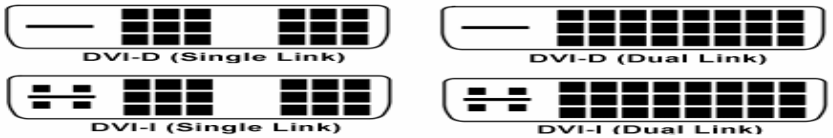
Single link

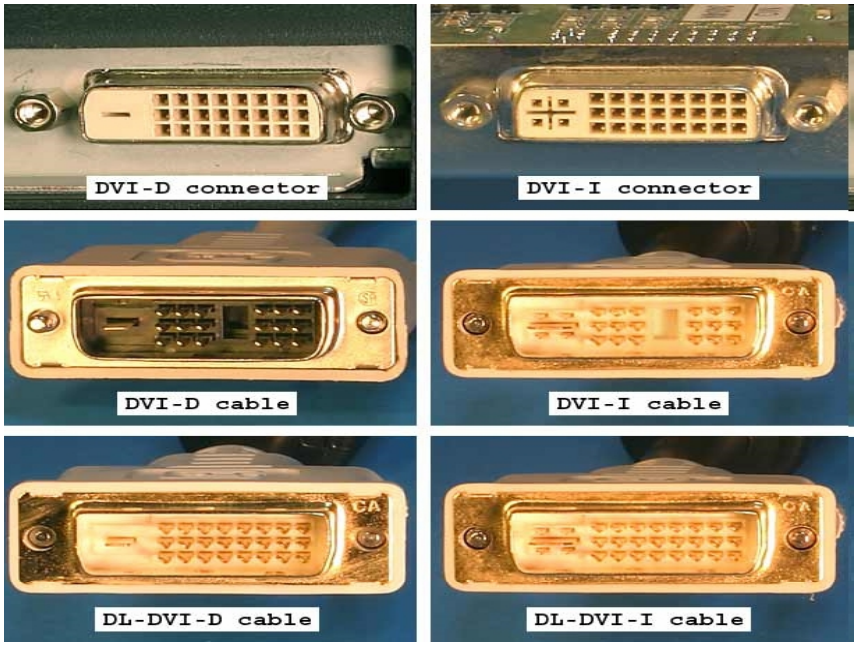
- uses 1 TMDS transmitter
- supports a 1920x1080 image

Dual link.

- uses 2 TMDS transmitter (extra pins)
- supports up to a 2048x1536 image.

A transmitter on the video adapter sends the digital information to a receiver in the monitor. TMDS takes the signal from the video adapter, determines the **resolution** and **refresh rate** that the monitor is using, and spreads the signal out over the available bandwidth to optimize the data transfer from computer to monitor.





DVI to VGA connectors
DVI To VGA Display Adapter

- These adapter cables or plugs are DVI at one end and VGA at the other.
- These are typically used to transmit a DVI signal from the video card to VGA at the monitor or vice versa.
- Each standard (DVI-D, A and I) has a respective adapter cable to accommodate the type of standard your system uses.

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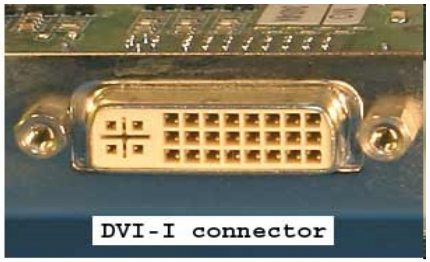

HDMI

HDMI
HIGH-DEFINITION MULTIMEDIA INTERFACE

- HDMI (High-Definition Multimedia Interface) is today the best kind of digital audio and video connector available that promises to replace all connectors currently used by players, cable/satellite decoders, TV sets, video projectors and video monitors.
- The idea is to use a single cable instead of several cables when connecting your HD-DVD player to your TV set,
- transfers digital video data (picture data) and digital audio data - both in one integrated cable
- No necessity of analogue-digital or digital-analogue conversion
- HDMI works without any data compression and therefore shows no loss in quality caused by the system
- Extremely high data transfer rates – up to 5 GB per second.
- Suitable also for longer distances up 100 m
- HDMI, cable length depends heavily on the materials used to construct the cable.
  Passive cables tend to extend 15 meters,
  active cables tend to extend 30 meters (adding electronics within the cable)
  Twisted-pair and fiber cabling options can extend cabling to 50 meters

HDMI Types male connector

Connector type*1	HDMI		
	Type A	Type C	Type D
Height (receptacle)	About 5.55mm*2	3.2mm	2.8mm
Width (receptacle)	About 15mm*2	11.2mm	6.4mm
Pin count	19	19	19
Pin rows	2	1	2

There is also a Type-B connector that has 29 pins and is intended to support higher resolution for the components that use it.
Type-B HDMI connectors are non-existent in that no dual-link HDMI consumer equipment has been released so far.

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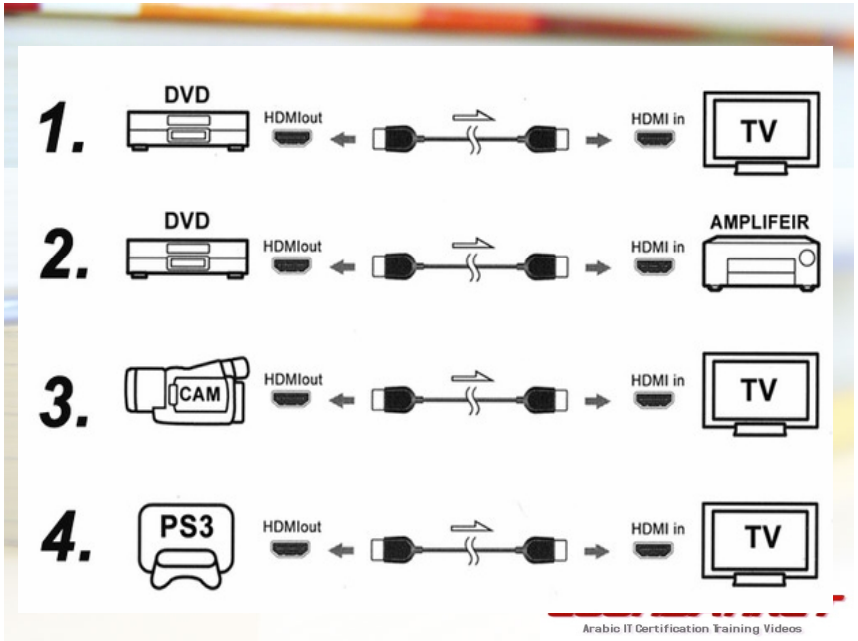

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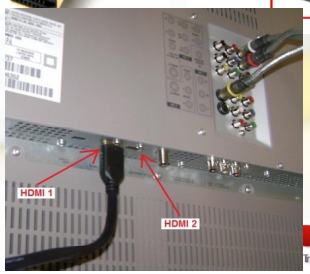
- HDMI is compatible with DVI-D and DVI-I cables through proper adapters, but only single-link is supported



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Component Video

- Component video is the standard for **analog** high definition **video**.
- A standard 3-RCA Component video cable does not include audio.
- Component video connectors have 3 coaxial jacks consisting of one red, green, and blue.

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- performs a signal-splitting function
- **Component video consists of three signals.**
- The first is the luminance signal, which indicates brightness or black & white information that is contained in the original RGB signal. It is referred to as the "Y" component.
- The second and third signals are called "color difference" signals which indicate how much blue and red there is relative to luminance.
- The blue component is Pb "B-Y" and the red component is Pr "R-Y". The color difference signals are mathematical derivatives of the RGB signal.
- Green doesn't need to be transmitted as a separate signal since it can be inferred from the "Y, B-Y, R-Y" combination.
- The display device knows how bright the image is from the Y component, and since it knows how much is blue and red, it figures the rest must be green so it fills it in.
- A digital version of this technology, usually found on high-end devices, replaces analog's Pb and Pr with Cb and Cr.

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DVD players

Samsung LE32A656 lcd rear connection

Component RCA to HD-15 Adapter Cable

RCA Component (RGB) Male

Super VGA High Density HD15 Male

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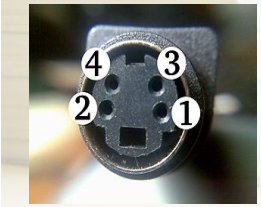
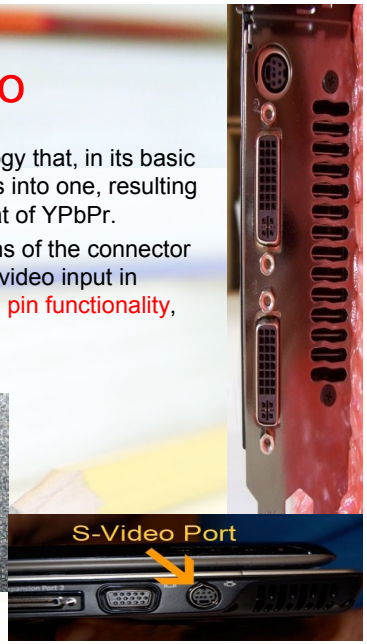
S-video

- S-video is a component video technology that, in its basic form, combines the two chroma signals into one, resulting in video quality not quite as high as that of YPbPr.
- ATI has used 8-, 9-, and 10-pin versions of the connector that include such added features as S-video input in addition to output, or even bidirectional pin functionality, and audio input/output.



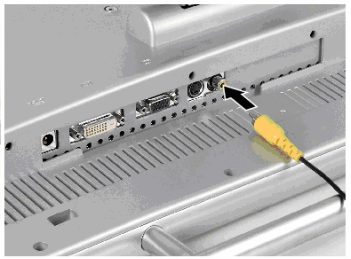
4-pin mini-DIN

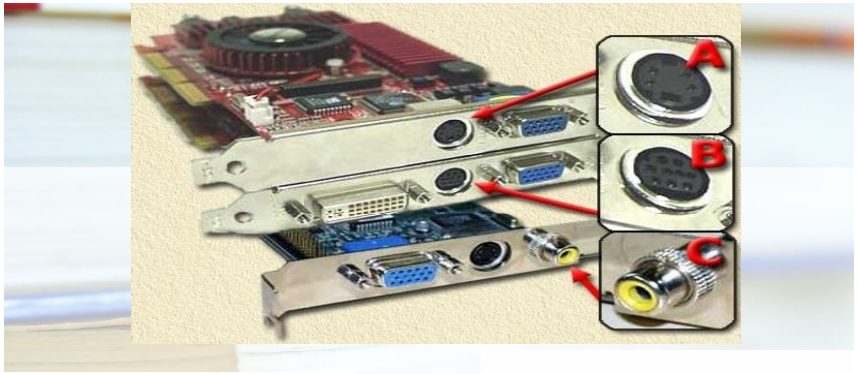
7-pin mini-DIN



Composite Video

- combines all luma and chroma leads into one.
- A single yellow RCA jack, the composite video jack is rather common on computers and home and industrial video compo





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